

PALEONTOLOGY OF THE EASTERN SNAKE RIVER PLAIN

Many of us share a curiosity about the plants, animals and landscape of the past. The "detective work" in recreating and interpreting prehistoric environments is done by paleontologists working with "clues" provided by vertebrate, invertebrate, and plant fossils, and their geologic settings. On the Snake River Plain, animal and plant fossils come from three primary localities.

The sands and gravels of the Snake River floodplain and ancient lake bed sediments have yielded the remains of late Pleistocene animals. This time period, known as the Rancho La Brea, is represented in southern Idaho by fossils of well-known "Ice Age" animals - mammoth, mastodon, sabre-tooth cat, horse, camel and large ground sloth.

Careful excavation of archaeological sites has given us a glimpse of the flora and fauna of the region in the form of plant and animal debris left behind by human inhabitants. This record, dating from approximately 15,000 years ago in southern Idaho, contributes to our understanding of the ecological changes between the end of the last glaciation and the initiation of modern climatic conditions, and cultural adaptations to this transition.

The basalt flows and volcanic features which dominate the Snake River Plain have served both to frustrate and augment the paleontology of the region. Our knowledge of the past natural history of the Plain itself is limited to the geologically "recent" last 100,000 years or so because volcanic activity tends to obliterate most organic remains. At the same time, this activity has produced features such as lava tubes, blisters, caves, rockshelters, and fissures which have served as shelters for living plants and animals, as traps for their remains, and as protected locations for their preservation.

"Lava tubes" are formed when molten basalt flows from its source across terrain with sufficient gradient to allow the flow to continue beneath a cooling, hardening, crust of rock. This crust forms the ceiling of the lava tube, which may empty for several kilometers before stopping. Tubes may remain hollow, may partially fill with subsequent flows, or gradually fill with water-borne fine sediments from the surface and rock fall from the walls and ceilings. Lava "blisters" come in many sizes and form when hot, expanding gases from molten basalt rise, often doming the surface of a flow as it cools.

AND WIND-

Lava tubes near the ground surface frequently collapse along ceiling fractures, producing a rubble-filled depression which enlarges by weathering and collapse of the dripline of caves opened at each end of the collapse. These caves (Figure 1) are attractive to animals as denning, roosting, and hibernating sites and offer protection to plants and the extra bonus of moisture from melting snow trapped in the depressions. Animal bones are introduced into the caves by natural mortality and hunting and scavenging by humans and other predators. Wind-blown water-redeposited fine sediments and rockfall from frost weathering gradually fill many of these tubes. This pattern of deposition, reflecting prevailing wind direction, buries the upwind tube cave and depression margin first. We now know that the prevailing wind direction on the Snake River

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Plain has been from the southwest for at least 12,000 years!

The deposits of lava tube caves and rockshelters contain an excellent and often well-preserved sedimentary and faunal record. Sites which have received the most scientific exploration are those which have Native American cultural materials as well. The bias of the tube features is reflected in the fact that information based on fossils must be interpreted in light of their mode of deposition. Humans are selective in what they hunt, gather or bring back to a living site. The season of occupation is often reflected in the kinds and ages of animals brought in. Pollen is introduced by human activity, but there is also a natural pollen rain within the caves. Humans and other occupants import, modify, and export bones. Most animals are able to enter, and leave, lava tube caves. These activities over time produce a fossil history that is valuable but incomplete, so care must be used in its interpretation.

Archaeological and paleontological work at Snake River Plain lava tube sites has recovered bones of extinct animals such as mammoth (Mammuthus sp.) and camel (Camelops sp.), and modern large animals such as bear (Ursus sp.), wolf (Canis lupus), bison (Bison bison), elk (Cervus canadensis) and pronghorn (Antilocapra americana). The bones of small animals, mainly deposited by roosting owls in regurgitated pellets, are most valuable to paleoecological reconstruction. Small mammals are especially sensitive to environmental change and have very specific ecological requirements. The identification of these species allows us to say something about climatic conditions, severity of seasonal temperature regimes, soil and vegetation characteristics in the past. Small animals identified from tube cave excavations include mammals, birds, reptiles, amphibians, snails, and even fish.

Many lava tubes have been explored and recorded in the search for likely fossil localities, although only a few have been excavated. As an interesting sidelight to these explorations, several grizzly bear denning sites have been noted well within tube or collapse features. These dens come complete with entry-way rocks well-polished by bear-traffic, hibernation hollows, and dung. Dung samples have been analyzed to determine the diet and parasites of the grizzlies, now extirpated on the Snake River Plain. Local informants indicate that the last of the grizzlies were shot in the 1920's, after cattle-grazing was initiated in the area south of Crater's of the Moon National Monument.

In addition to owls, humans, and coyotes, packrats come out near the top as contributors to the fossil record. Packrats, or woodrats (Neotoma sp.), build nests in sheltered locations in talus, along the walls of collapse depressions, and just inside tube caves and lava blisters. Their reputation for hoarding is well-deserved and they build protective nests of twigs, leaves, cactus spines, procupine quills, bones, (and candy wrappers, flashlight batteries and articles of clothing!). Nests can become quite large and represent many years, centuries in some locations, of accumulation. Paleontologists like packrat nests for their antiquity and the fact that they represent collections of very local plants and animal remains since Neotoma range only a short distance from the nesting site. The value of vegetable and animal

remains in the nest is enhanced by the fact that they are cemented by highly concentrated urine or "amber rat" which hardens and preserves the contents. Nests can be excavated and dissected to obtain pollen and plant macrofossils, vertebrate and invertebrate remains (snails and insects), and samples for radiocarbon dating. In this way any environmental changes in the local biological communities sampled by packrats can be tracked through time.

Although there is much left to be done, some of the most extensive paleoecological work to date has taken place at lava blister sites (Figure 2). Blisters frequently have modest openings at ground level where ceiling collapse and weathering has occurred. These openings are often well-concealed and nearly invisible until closely approached. (The same is also true of even larger collapse depressions, a feature used to advantage by prehistoric hunters as well-camouflaged traps or pitfalls during bison drives.)

For paleontological study, the best blister sites have served as true faunal traps where animals can jump or fall in, but not escape. These traps operate by catching the occasional unwary running animal, or by deception. The depth from opening to the floor is often misjudged by animals, due to plants growing directly beneath the opening (Figure 3), or by snow drifts that accumulate in winter. From work at Snake River Plain blister sites, a "recipe" for a good faunal trap has been developed. The site opening is generally from two to eight feet in diameter and the drop to the floor between eight and twelve feet. The blister should be relatively smooth-ceilinged and bell out or spread underground from the opening.

This conformation is important to (1) deceive animals about the true depth and allow most of them to survive the fall or jump in, and (2) provide no escape by climbing or jumping through the opening or out along any connecting side chambers or passages.

The animal species found at these sites support this interpretation of trap function in two ways. First, among the animals recovered from these traps, carnivores appear in abnormally high numbers. We speculate that the high survival rate among smaller prey animals, such as squirrels and rabbits, served to "bait" the trap and entice hunting species to enter. Many paleontological sites contain a proportion of carnivores to herbivores which more nearly approximates the census on any landscape. For example, if you were to collect all species from a mile square area anywhere, herbivores would far outnumber carnivores, approximately 98 to 2. At trap sites such as Moonshiner (Figure 3) or Middle Butte Caves on the eastern Snake River Plain, the ratio is herbivores only 70% to 30% carnivores.

Faunal traps studied on the Snake River Plain have been collecting bones perhaps as long as 10,000 years, or from the beginning of the Holocene. Animals represented are of many species living on the Plain today, some species which are now extinct, such as the noble marten, some which have been extirpated since historic times (wolverine, bison), and some, like the Canadian lynx, whose natural ranges have shifted north or into higher elevations as the result of environmental change.

At some sites the change in fauna through time reflects a change in the site itself. At one location, the lowest or oldest

100
feet
snow
drifts
usually

deposits were dominated by the bones of rattlesnakes. Upper or later deposits contained bones of small animals such as packrats, mice, and birds. The site must have initially been protected and enclosed and used as a hibernaculum or communal hibernating den by rattlesnakes. Sometime later, collapse or weathering of rock opened the site for other animals to use, and their bones were introduced into the deposits.

Packrat middens at various locations on the eastern Snake River Plain and faunal trap sediments have been sampled and analyzed for pollen grains and plant fragments. The ecological information from the identification of plant species and the shifts in vegetation types and abundance through time can then be used to track changes in the local environments of the past. The dating of strata, pollen and bone assemblages can be accomplished in a number of ways to order the sequence and date of deposition to establish a chronology for the paleontological sites. This is done by radiocarbon analysis of organic remains and the presence in the deposits at some sites of distinctive volcanic ashes of known origin and age.

The paleontologic and archaeologic information gained from these studies has allowed us to begin to characterize the past environments of the Snake River Plain. This knowledge also allows us to speculate (not without controversy!) about the antiquity and causes of the unique natural history of the Plain, and the nature of plant, animal and human adaptations to its ecology. We know that glaciation in the mountains to the north had an effect on the vegetation, climatic patterns, and moisture available, throughout the Pleistocene and up until about 12,000 years ago. The climate began to change subtly, initiating the cool dry conditions of the present day, around 10,000 years ago. Through mechanisms that we do not fully understand, this time also marked the extinction of large mammals such as the mastodon, mammoth, camel and native horse, and the loss of some smaller animals to extinction or range shift away from the Snake River Plain.

Figure 1. View inside Bare Bonze II, a typical "cave" formed in a lava tube on the Snake River Plain. (The cave mouth, which opens into the collapse depression is behind the photographer). The small ceiling opening is an occasional feature of tubes, and may indicate that the site functioned as a trap before the collapse opened the site. The floor in this area is littered with animals bones from roosting and nesting owls and debris from packrat nests. Concealed at the rear of this chamber is the entry to a former grizzly bear den. Bare Bonze is located in older basalt in a kipuka surrounded by the more recent Wapi flow south of Craters of the Moon National Monument.

Figure 2. Many blister faunal traps are successful because their openings are small and level with the ground surface, a surprise for the unwary. A ground-squirrel's view of the entrance to a faunal trap under investigation west of Mountain Home, Idaho.

Figure 3. Moonshiner Cave, the site of extensive paleoecological work, is a "classic" faunal trap. Moonshiner is located on the Idaho National Engineering Laboratory, east of East or Tower Butte, a local landmark. Note the ferns growing directly beneath the

opening; the depth at this point is about 10 feet.

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